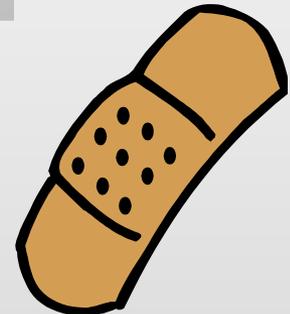
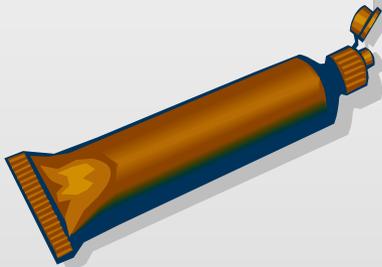
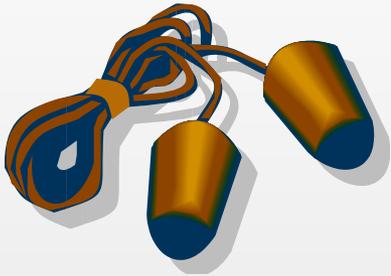




Glenn Research Center

Medical Consumables Tracking (MCT)





HRP Gap that MCT Addresses



Glenn Research Center

Gap 4.14 - We do not have the capability to track medical inventory in a manner that integrates securely with the medical system during exploration missions



MCT Goals



Glenn Research Center

Technical ISS Demonstration Testing Goals

- Demonstrate that the system correctly identifies that an item has been removed
- Transmit data to the SSC via ISS JSL
- Verify functionality in the electrically noisy ISS

Advantages

1. Scheduled crew time not required to inventory medications/medical consumables; supplying more time for other activities
2. Know when medical supplies are low
3. Actual usage data can be used to resupply the kits
4. Actual usage data used for exploration mission planning



Concept of Operations (on-orbit)



Glenn Research Center

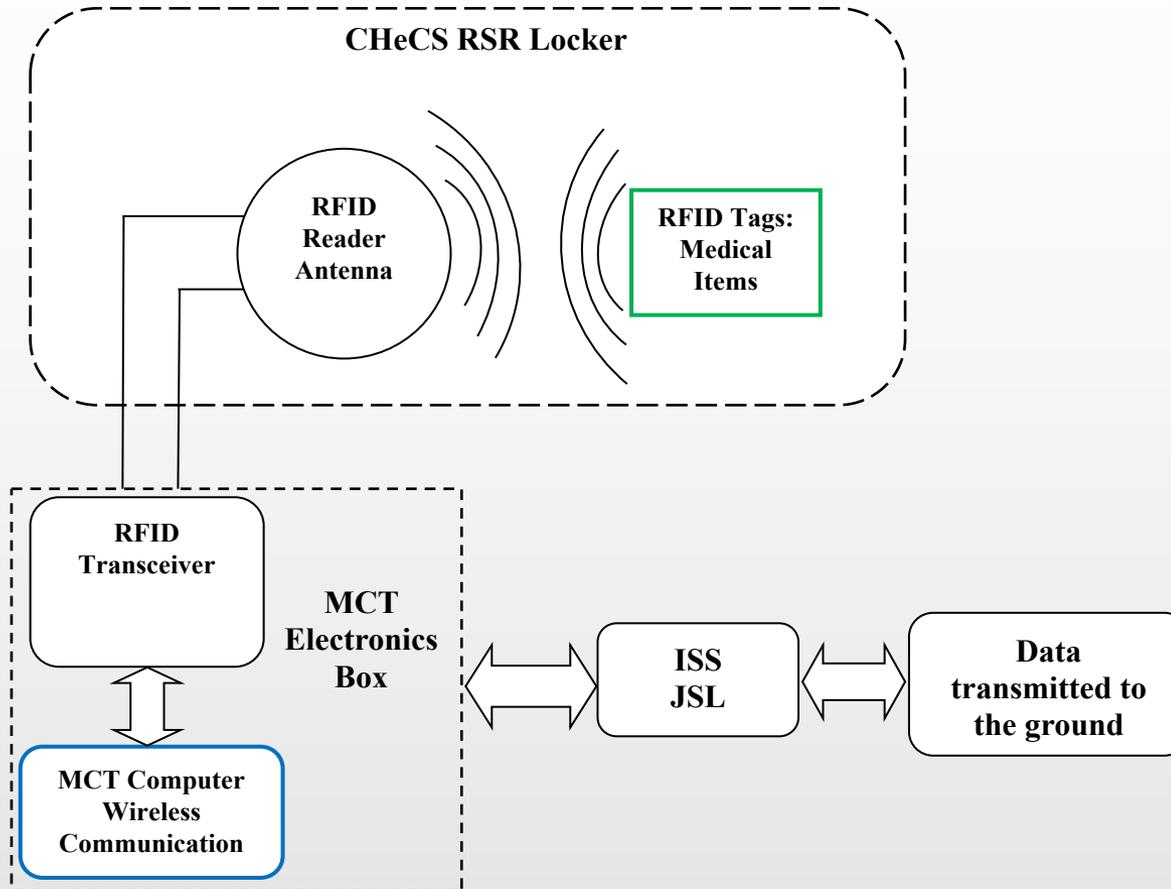
- RFID tags are attached to the contents of the Convenience Medications Pack (pharmaceuticals), and foam ear plugs, which are kept in a CHeCS RSR (Resource Supply Rack) locker
- MCT Hardware installed inside the CHeCS RSR locker and on the outside of the locker door
- The crew will access medications and consumables as before (no procedural changes)
- MCT system will turn on and read (perform inventory) RFID tagged items in the locker once every 30 days
- The inventory report (RFID tag numbers only) is transmitted wirelessly to the Joint Station LAN then downlinked to the HMS Inventory Tracking Tool (HITT) database that has tag id to item id cross-reference info
- The crew can perform an inventory via a switch located on the Electronic Box



MCT Technology



Glenn Research Center



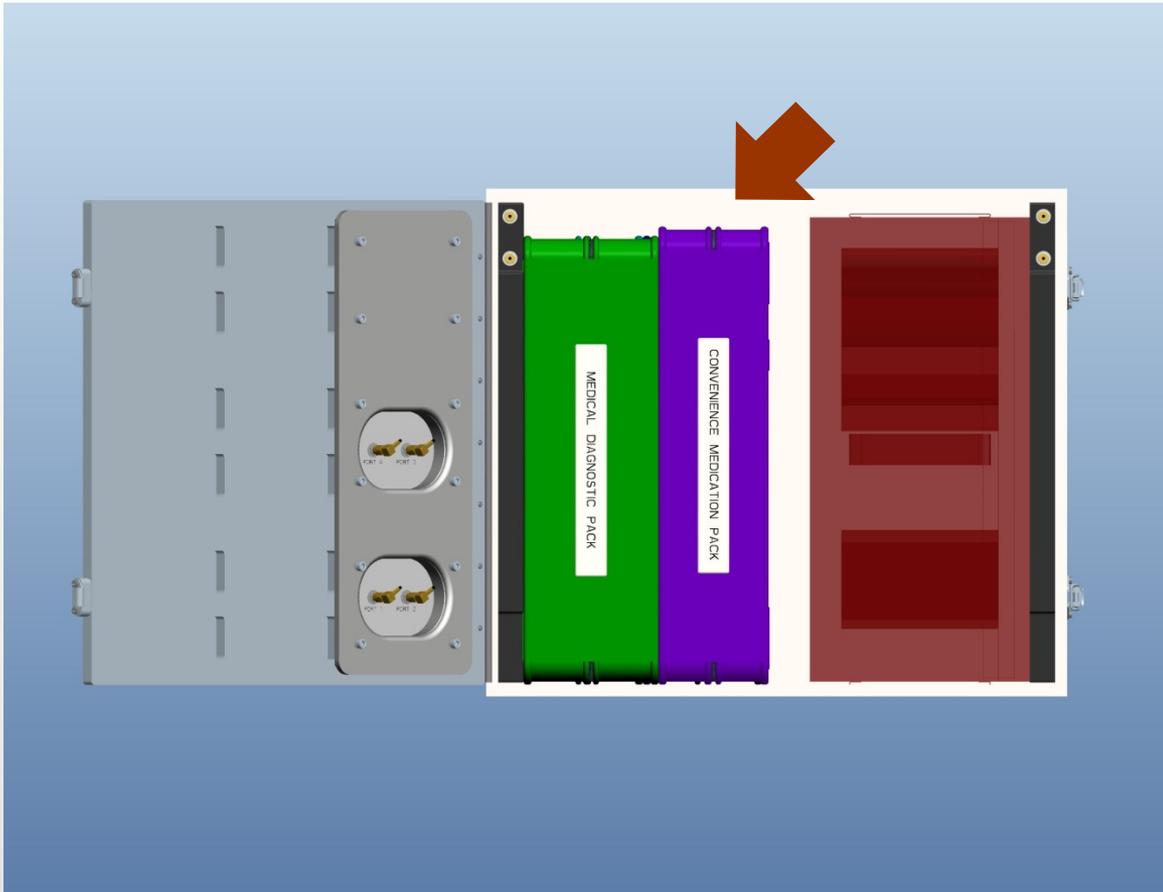


What will MCT track?



Glenn Research Center

CHeCS RSR Locker D2



- The MCT System is currently tasked to track the Convenience Medications Pack and Ear Plugs
- The above items were selected for tracking because they are items most frequently used by the crew
- Tagging - individual items or dose levels for pills
- 503 items = 503 RFID tags



MCT Hardware Overview



Glenn Research Center

The MCT Hardware consists of:

- Embedded Computer System
- RFID Near-field Antennas (2)
- RFID Reader/Writer
- Inventory Control and Power Converter Assembly
- RFID Tags

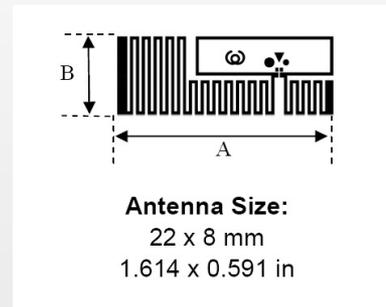


RFID Tags

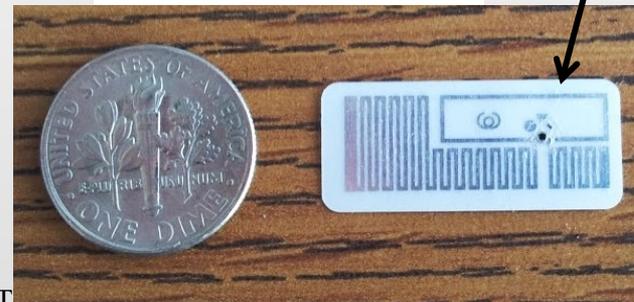


Glenn Research Center

- RFID Tags
 - Consist of a RFID chip and small antenna
 - Tag antenna is energized from the system reader and antenna
 - Chip is activated and transmits its Electronic Product Code (EPC) Value back to the reader
 - At present, the MCT system is tasked to read ~400 tags, but may increase depending on future Med Kit packing densities



← RFID Tag



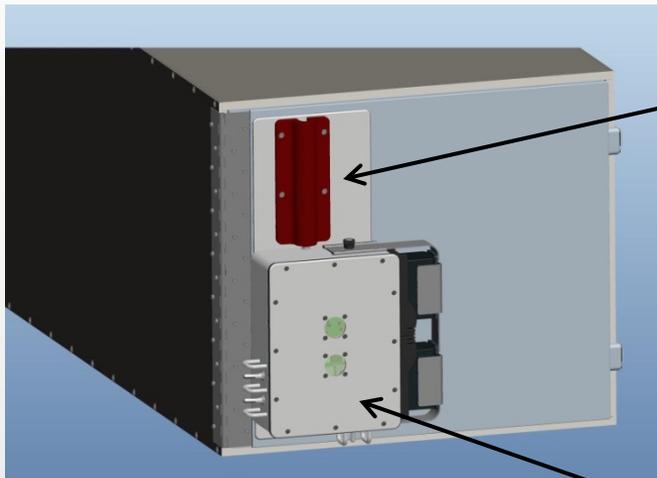


Hardware Installed on the Door



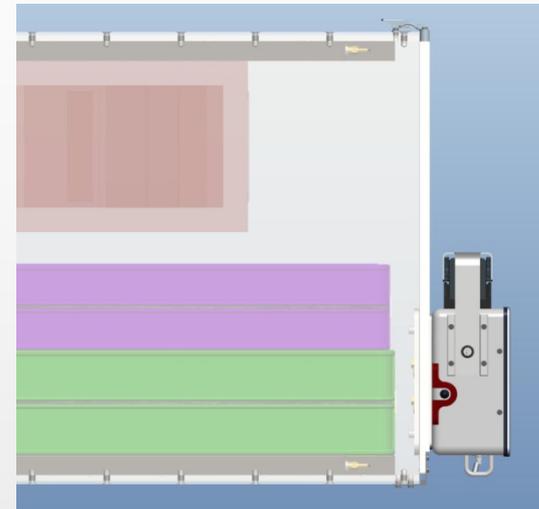
Glenn Research Center

A thermal gasket will heat sink the electronics box to the panel that attaches to the locker door.



Front of D2 Locker Door
(hardware installed)

Electronics Box



Profile with locker door closed
(top down view)



RFID Tag Installation



Objectives when tagging items:

- MCT team will provide instructions as to the tag type, optimum orientation, and position of the RFID tag on each medical item
- RFID tags placed on packaging must not interfere with ease of opening
- RFID tags must not obscure labeling of unit dose
- Addition of RFID tags must add minimal bulk to existing item packages
- Where possible place the RFID tag on the item itself, if not then RFID tag will be placed on re-closable bag.



RFID Tagging Plan



- RFID tags will be pre-programmed with EPC code
- The EPC value will have the letter 'M' programmed in the most significant byte location followed by 'MCT'. This signifies that the RFID tag is attached to a Medical Consumables item
- MCT will provide programmed RFID tags on a roll
- RFID tag will be removed from roll and placed on Ziploc bag or directly on item (where possible)
- Medication label will be placed on top of RFID tags located on the Ziploc bag
 - The addition of the Medication label improves separation between the RFID tags, providing improved reading capability
 - Provides protection for the RFID tag



System Inventory



Glenn Research Center

- Inventory schedule once every 30 days
- Inventory takes less than 5 minutes
- Crew have the ability to initiate an inventory cycle manually
- Crew can access medications at any time
- If during a crew access MCT initiates an inventory period or during an inventory period there is crew access, MCT will automatically terminate the inventory period and start another period once no access activity is detected
- Inventory is only performed when the locker door is closed
- LED indicator on the Electronic Box will illuminate when an inventory cycle is being performed
- All items detected are recorded and sent to the JSL server



MCT Tags



Two different UHF RFID tags, each using the Impinj Monza 5 RFID chip, were selected for testing.

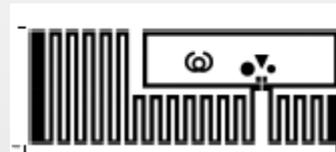
Invengo Scorpion XCTF-8039-C13-FPI: This inlay is optimized for small and medium distances, which is suitable for pharmacy, clothing or assets tracking applications.

LAB-ID SKL4020-MZ5 This inlay is used in apparel tracking or item level tracking applications.

An image of each RFID inlay is shown below



SKL4020-MZ5



Scorpion (XCTF-8039-C13-FPI)

*Images are not to scale



MCT Testing



The MCT RSR CHeCS (*Crew Health Care System*) enclosure is an aluminum chassis with an approximate volume of 3.6 ft³. The enclosure will perform as a Faraday cage and restrain the transmitted RF from interfering with external equipment. This enclosure can contain 6 medical packs each measuring $\approx 16.4'' \times 14.5'' \times 4''$. Each pack can contain as many as 350 densely packed RFID tags. Tagged materials are in the form of metals, liquids, plastic, paper, and tablet medications (packaged and blister packs).

The two custom Applied EM antennas are attached to the left and right side walls of the chassis. The ThingMagic RFID reader/writer is located on the top (outside the environment).



MCT RSR CHeCS Locker Simulator



Antennas Mounted Left Wall



Antennas Mounted to Right Wall



MCT Testing (cont'd)



Glenn Research Center

The Convenience Medications Pack contains the non-contingency medication for afflictions deemed to be frequent and which require oral, injectable, or topical administration. The Convenience Medications Pack Assembly is packaged in a 16" x 14" x 4" blue Nomex bag. A nylon zipper wraps around 3 sides of the bag on the 4" wall to allowing it to open and lay flat. Most of the sub-assemblies are contained inside small zipper lock bags with a hook fastener attached to secure to the inside of the bag.



The MCT Convenience Medications Pack contains either the exact same type medical item or in the case of oral medications a placebo.